

How and how well do pediatric radiology fellows learn ultrasound skills? A national survey

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Abstract

Background Ultrasound (US) comprises a significant portion of pediatric imaging. Technical as well as interpretive skills in US imaging are consequently fundamental in training pediatric radiologists. Unfortunately, formalized technical education regarding US imaging in pediatric fellowships has lagged.

Objective We surveyed pediatric fellows and program directors regarding US scanning education to improve this experience moving forward.

Materials and methods We conducted an online survey from February 2011 to March 2011 of all United States pediatric radiology body imaging fellows and fellowship program directors. Questions posed to fellows assessed their educational US experiences during their residencies and fellowships. Directors were asked to evaluate US educational opportunities in their programs.

Results Among the respondents, 43.9% of fellows undertook on-call US scanning without a sonographer during residency, 23.3% during fellowship; 41.8% of fellows and 58.6% of program directors reported that their fellowship had a dedicated curriculum to facilitate independent US scanning. Both fellows and program directors cited the volume of cases requiring immediate dictation as an obstacle to scanning. Fewer program directors than fellows identified lack of sufficient staffing as an

obstacle, but more identified fellow disinterest. Program directors and fellows alike rated independent US scanning as highly important to pediatric radiologists' future success.

Conclusion Pediatric radiology fellowship directors and fellows agree that technical US skills are crucial to the practice of pediatric radiology. However, the groups identify different obstacles to training. As US instruction is developing in undergraduate medicine and subspecialists are acquiring point-of-care US skills, pediatric radiology education should address the obstacles to US training and formalize a curriculum at the fellowship level.

Keywords Ultrasound · Education · Fellowship · Training · Pediatric

Introduction

Pediatric radiology fellowships in the United States, under the auspices of the Accreditation Council for Graduate Medical Education (ACGME, www.acgme.org), include a minimum of 12 months of post-diagnostic radiology residency training. The purpose of a pediatric radiology fellowship is to gain subspecialized diagnostic imaging skills and knowledge specific to the pediatric population. The ACGME helps to regulate the training curriculum, which has expanded in recent years with new technologies and emphasis on patient and radiation safety. Although pediatric radiology fellows who successfully complete diagnostic radiology residencies are trained in adult sonography, pediatric sonography poses several distinct challenges that should be addressed with additional training. First, children are not always as cooperative as their adult counterparts, especially in the setting of illness, pain or fear. Second, in order to image the developing and growing child, technical parameters including choice of transducer and knowledge of image optimization are more critical.

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Third, the smaller body habitus and immature skeleton permit US examination of anatomy not routinely performed in adults, including the developing brain, spine and hips, techniques for which require additional practice. Fourth, there are pediatric-specific pathologies never or rarely encountered in adults that are primarily diagnosed with US, e.g., hypertrophic pyloric stenosis. Training in pediatric US is especially crucial because US is heavily relied on for diagnostic imaging in children because of the pressing need to reduce or eliminate alternative imaging modalities that expose children to radiation.

Some institutions have one or more in-house sonographers available around the clock to perform examinations, but fewer have dedicated pediatric sonographers. It is ultimately the responsibility of the pediatric radiologist to make the US diagnosis and ensure that the proper images are obtained to do so. The pediatric radiologist must be skilled in acquiring US images, assisting the sonographer in difficult cases and instructing sonographers with limited or no pediatric experience on the specifics of pediatric sonography. In this setting and with increasing requirements incorporated into 1-year fellowship training programs, we must ask ourselves whether we are adequately assisting trainees to develop a US acquisition skill set that is invaluable to the practice of pediatric radiology.

To begin to answer this question, we sought to understand how pediatric radiology fellows and fellowship directors perceive their US training experiences and programs.

Materials and methods

An online survey was sent to all pediatric radiology fellowship program directors and pediatric radiology body imaging fellows in the United States. This was carried out through e-mails with a link to a questionnaire using the Survey Monkey Program offered at www.surveymonkey.com. E-mail addresses for the pediatric radiology fellowship directors were available from the listing by the ACGME. Pediatric radiology fellow e-mails were solicited through individual fellowship program coordinators and the Society for Pediatric Radiology (SPR).

The survey comprised primarily multiple-choice questions with drop-down options and free text options. Initially, a pilot survey was sent to the eight body imaging pediatric radiology fellows at our own institution. Questions were revised based on feedback from the pilot survey. Pediatric radiology body imaging fellows were sent a 15-question survey and fellowship directors an 11-question survey, together with an introductory letter explaining the purpose of the survey and indicating that responses would be anonymous. The survey questions for both the fellowship directors and the fellows are listed in Tables 1 and 2, respectively.

Table 1 Pediatric radiology fellowship program director survey

1. In the past 5 years, has your pediatric radiology fellowship program had at least 1 fellow enrolled each year?
2. Are there trainees currently participating in your institution's pediatric radiology fellowship program?
3. If applicable, how many trainees are currently participating in your institution's pediatric radiology fellowship program?
4. If applicable, how many trainees are currently participating in your institution's body imaging pediatric radiology fellowship program (excluding neuroradiology and IR fellows)?
5. In your opinion, how important a factor is proficiency in independent US scanning to your fellows' future success as pediatric radiologists? (1 = not important–10 = critically important).
6. Does your fellowship program offer a dedicated curriculum or instruction to facilitate a fellows' education in independent US scanning?
7. If applicable, which of the following are features of your fellowship program's curriculum/instruction in independent US scanning? Choose as many as apply:
 - Didactic lectures
 - Hands-on equipment tutorials with sonographers
 - Hands-on equipment tutorials with radiologists
 - Volunteer patients
 - Graded unsupervised scanning during rotations
 - Graded unsupervised scanning during call
 - Periodic evaluations of performance in scanning
 - Funding for outside institution instruction in scanning
 - Additional staffing/resident to allow fellows to leave workstation
 - N/A
 - Other (explain)
8. If there are obstacles to independent US scanning for fellows while on dedicated ultrasound rotations, which would you consider problematic for learning? Choose all that apply:
 - Volume of cases requiring immediate dictation
 - Lack of sufficient staffing/residents to allow fellow to leave workstation
 - Resistance of faculty toward working without a trainee
 - Technologist disapproval of workflow disruption
 - Anxiety of fellows regarding weaknesses in scanning independently
 - Lack of interest among fellows
 - No apparent obstacles
 - Other (explain)
9. If applicable, are your fellows responsible for independent US scanning without the presence of a sonographer while on-call?
10. If applicable, does your institution have in-house or remote evening attending coverage to provide final interpretations of unsupervised cases performed by your fellow?
11. How would you rate your pediatric radiology fellowship program's overall quality of instruction for fellows in independent US scanning (1 = poor–10 = excellent).

The surveys were completed from February 2011 through March 2011. Two reminder e-mails asking for a response were sent out before the survey was closed. Responses were automatically put into a data file, stored on a Web server, and then

Table 2 Pediatric radiology fellow survey

1. Did your residency or pediatric radiology fellowship program offer the opportunity for independent ultrasound scanning?
2. How would you rate your educational experience in independent US scanning during residency and fellowship? (N/A or 1 = poor–10 = excellent).
3. If applicable, who was primarily responsible for your education in independent US scanning during your residency and fellowship?
4. Did you participate in independent US scanning while on US rotations during your residency or fellowship?
5. If applicable, how much time per day was spent performing independent scanning during US rotations in residency or fellowship?
6. If there are obstacles to independent US scanning for fellows while on dedicated US rotations, which would you consider problematic for learning? Choose all that apply:
 - Volume of cases requiring immediate dictation
 - Lack of sufficient staffing/residents to allow fellow to leave workstation
 - Resistance of faculty toward working without a trainee
 - Technologist disapproval of workflow disruption
 - Anxiety of fellows regarding weaknesses in scanning independently
 - Lack of interest among fellows
 - No apparent obstacles
 - Other (explain)
7. Were you responsible for independent US scanning without the backup of a sonographer while on call during residency and/or fellowship?
8. If applicable, how many unsupervised cases did you perform during any 24-h period on call during residency or fellowship?
9. In your opinion, how important a factor is proficiency in independent US scanning to a fellow's future success as a pediatric radiologist? (1 = not important–10 = critically important).
10. How important a factor was the opportunity to perform independent US scanning in choosing your particular pediatric radiology fellowship program? (1 = not important–10 = critically important)
11. Does your pediatric radiology fellowship program offer a dedicated curriculum or instruction to facilitate independent US scanning?
12. Which of the following are features of your fellowship program's curriculum/instruction in independent US scanning? Choose as many as apply:
 - Didactic lectures
 - Hands-on equipment tutorials with sonographers
 - Hands-on equipment tutorials with radiologists
 - Volunteer patients
 - Graded unsupervised scanning during rotations
 - Graded unsupervised scanning during call
 - Periodic evaluations of performance in scanning
 - Funding for outside institution instruction in scanning
 - Additional staffing/residents to allow fellows to leave workstation
 - N/A
 - Other (explain)
13. Assuming limited overall elective time, how likely would you be willing to choose an elective in independent US instruction over additional time in another area of pediatric radiology? (1 = extremely unlikely–10 = extremely likely).
14. Would you be open to working under the guidance of a sonographer to learn independent US scanning?

Table 2 (continued)

15. How would you rate your interest in participating in an independent US scanning curriculum during fellowship that required non-work/non-call hours in the hospital? (1 = extremely disinterested–10 = extremely interested).

imported into an Excel® spreadsheet (Microsoft, Redmond, WA) for data analysis.

Results

Surveys were e-mailed to a total of 134 people—80 pediatric radiology body imaging fellows and 54 pediatric radiology fellowship program directors. The survey response rate was 43/80 (54%) and 29/54 (54%) for fellows and fellowship directors, respectively. One of the responding program directors did not answer question seven. Two fellows did not respond to the residency portion of questions one, two, four, five, seven and eight. One fellow did not respond to the fellowship portion of question one. Forty of the 43 fellow survey responses were complete.

Of the responding 29 fellowship programs, 69% had enrolled at least one new pediatric radiology fellow annually in the last 5 years. For the 2010–2011 academic year, 26/29 (89.7%) of the programs enrolled a total of 88 pediatric radiology fellows. The total number of pediatric radiology fellows in each of these 26 programs ranged 1–15, with 84.6% having four or fewer fellows and 15.4% with eight or more fellows. Sixteen of the responding fellowship directors indicated that they had dedicated body imaging fellowships with 1–10 fellows in each program. These 16 programs enrolled a total of 57 pediatric body imaging fellows.

Of 41 responding fellows, 78% ($n=32$) reported independent US scanning opportunities during their residency; of 42 responding fellows, 88.1% ($n=37$) reported similar opportunities in their fellowship program. The actual participation rate in US scanning while on dedicated US rotations during residency and fellowship was 76% (31/41) and 81% (34/42), respectively.

On-call US scanning without the assistance of a sonographer was reported by 44% (18/41) during residency and 23% (10/43) in fellowship. When independent on-call scanning was performed, seven respondents imaged nine or more patients in a 24-h resident call while four reported imaging nine or more patients in a 24-h fellow call. Program directors were also queried regarding the on-call US scanning responsibilities of their fellows. Eight program directors (27.6%) reported that unsupervised US cases were performed by fellows without the back-up of a sonographer. In-house or remote attending coverage for all unsupervised US cases performed after hours was reported by 58.6% ($n=17$) of the program directors.

Table 3 Features of pediatric radiology fellowship US scanning curriculum/instruction from the responses of body imaging pediatric radiology fellows ($n=43$). Please note that the instruction was to choose as many as apply

Types of curriculum/instruction	<i>n</i>	%
Hands-on equipment tutorial with sonographers	19	44.2
Additional staffing on US rotations	14	32.6
Didactic lectures	12	27.9
Graded independent scanning responsibility on call	10	23.3
Graded independent scanning responsibility on rotation	10	23.3
Hands-on equipment tutorial with radiologists	7	16.3
Periodic evaluations of performance in scanning	6	14.0
Funding for outside instruction in scanning	5	11.6
Volunteer patients	3	7.0
Other	4	9.3

Regarding a dedicated US curriculum, 41.9% ($n=18$) of the fellows responded that their fellowship program offered a dedicated curriculum or instruction to facilitate independent US scanning, and 58.6% ($n=17$) of program directors indicated that their fellowship offered trainees a dedicated scanning program. Respondents were asked to identify features of their program’s US curriculum from a list of choices. Hands-on equipment tutorials with sonographers (44.2%, $n=19$) and additional staffing on US rotations (32.6%, $n=14$) were the most common components, with the remaining distribution presented in Table 3. One fellow wrote that online modules were part of the curriculum.

Fellows reported that sonographers were primarily responsible for their education in independent scanning during fellowship (41.9%, $n=18$), followed by staff radiologists (32.6%, $n=14$) and independent learning (14.0%, $n=6$). Overall, most fellows responded that they were open to working under the guidance of a sonographer for this purpose (93.0%, $n=40$).

Respondents’ experiences performing independent US studies while on dedicated US rotations varied: 37.2% ($n=16$) spent

less than 1 h; 44.2% ($n=19$) spent between 1 h and a full workday; and 4.7% ($n=2$) spent the entire workday scanning. Fellows and program directors were asked to indicate possible obstacles to scanning during workday rotation from a list of possible options. The most common obstacles cited by the fellows were volume of cases requiring immediate dictation (65.1%) and lack of sufficient staffing to leave the workstation for scanning (55.8%). Program directors cited volume of cases requiring immediate dictation (51.7%) and technologists’ disapproval of workflow disruptions as the most common obstacles (41.4%). Lack of sufficient staffing was identified by fewer program directors than fellows, 24.1% vs. 55.8%. On the other hand, lack of fellow interest for scanning was selected more frequently by program directors, and not fellows, 41.4% vs. 14.0% (Fig. 1). One fellow commented that it was difficult to explain to families that the sonographer was teaching the fellow to scan, while the fellow was the physician interpreting the study.

Fellows and program directors were asked to rate proficiency in performing independent US scanning with regard to professional development on a scale of “not important” to “critically important.” Both groups deemed independent US scanning as a very important factor: 93.1% ($n=27$) of program directors and 76.7% ($n=33$) of fellows rated it as being of major or critical importance (Table 4). Fellows were subsequently asked, on the same scale, how important the opportunity to perform independent US was in their decision to choose a particular pediatric radiology fellowship program. A majority of fellows (62.8%, $n=27$) responded that independent US scanning carried minimal or no importance as a factor in their fellowship program selection. However 41.9% of fellows indicated above average to great interest in the idea of a proposed curriculum that would require non-work, non-call hours in the hospital. Almost half of fellows, 49%, expressed interest in elective time for independent US instruction. Three-fourths of fellows responded to these two questions similarly, that is the respondent marked both negatively or both positively. Of the 13 fellows whose responses were in

Fig. 1 Obstacles to independent US scanning for fellows during dedicated US rotations from responses of both pediatric radiology program directors ($n=29$) and body imaging pediatric radiology fellows ($n=43$). Please note that the instruction was to choose as many as apply

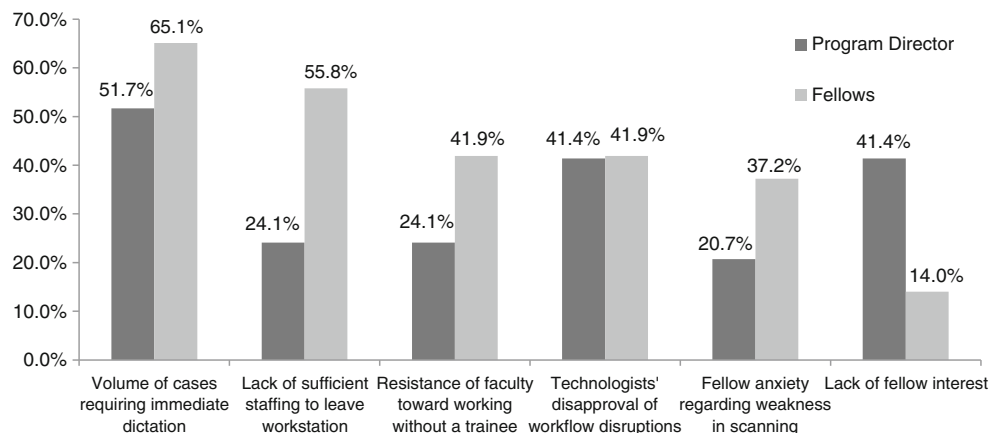


Table 4 Proficiency in performing sonography independently as a factor in future success as a pediatric radiologist

	Not important (1–2)	Minimal importance (3–4)	Some importance (5–6)	Major importance (7–8)	Critical importance (9–10)
Fellows (<i>n</i> =43)	2.3% (<i>n</i> =1)	2.3% (<i>n</i> =1)	18.6% (<i>n</i> =8)	39.5% (<i>n</i> =17)	37.2% (<i>n</i> =16)
Program directors (<i>n</i> =29)	0.0% (<i>n</i> =0)	0.0% (<i>n</i> =0)	6.9% (<i>n</i> =2)	48.3% (<i>n</i> =14)	44.8% (<i>n</i> =13)

opposite directions, seven were more likely to choose after hours scanning time over elective time.

Last, fellows and program directors were each asked to rate the current pediatric radiology fellowship independent US instruction educational experience on a scale of poor to excellent. The US educational experience was rated as poor (1–2) or below average (3–4) by 11.6% of fellows and 3.4% of program directors (Table 5).

Discussion

Sonography is a core component of imaging pediatric patients. At our institution, a free-standing academic children's hospital, about 31,000 US exams are performed annually. Thus approximately 16% of our 200,000 annual examinations are sonograms. This is in comparison to body CT (8,500) and MRI (21,000) examinations, which comprise 4.3% and 11% of our total imaging volume. US is diagnostic without radiation. It is also non-invasive, portable, and can evaluate in real-time anatomy and physiology. However, among all imaging modalities US is most operator-dependent. Therefore trainees must master not only interpretive but also the technical skills of acquiring diagnostic images.

The American College of Radiology (ACR), Society for Pediatric Radiology (SPR) and Society of Radiologists in US (SRU) guideline for performing and interpreting diagnostic US examinations qualifies residents who have completed diagnostic residency and have participated in the "supervision and/or performance, interpretation, and reporting of 500 US examinations in the past 36 months" as successfully meeting criteria to perform independent US [1]. Increased experience has been shown to improve technical US skills [2]. Pediatric radiologists have long understood that setting objectives and expectations, developing curriculum and evaluating trainees are all crucial to the future development of the field [3]. However, the US guidelines for pediatric fellowships are not so well-developed.

Previous versions of the ACGME fellowship program requirements mandated provision of at least 300 US examinations during a 1-year fellowship period. However, this language has not been included in recent versions of the document [4]. Effective July 1, 2010, the ACGME modified the pediatric radiology fellowship accreditation requirements and attempted to address the changes posed by the new American Board of Radiology examination for board certification in diagnostic radiology. Renewed emphasis on patient safety, recognition of normal variants, radiation reduction strategies, improved overall core competency, and elimination of procedure logs were specifically addressed [5]. The changes did not discuss educational issues related to meeting the challenges of pediatric US interpretation or independent scanning, as stated below:

IV.A.3a): The pediatric radiology program should provide rotations in chest, body imaging, abdominal and genitourinary imaging, emergency call, ultrasound, musculoskeletal, nuclear medicine, fluoroscopy, vascular/interventional, neuroradiology, cardiology and fetal imaging.

IV.A.3a).(1): Rotations may have different lengths and designated rotations should be designed by the program director with the faculty [4].

Thus institutions have not been required to provide specific US skills training, even though pediatric sonography presents unique challenges and opportunities. These skills and knowledge form a foundation for the understanding of expanding US technology and applications including 3-D imaging, elastography and contrast-enhanced US. Fellowship training is the ideal time to impart this base of knowledge and develop the necessary skill set.

Despite the lack of specific ACGME requirements for performing independent US, surveyed fellows and program directors were in strong agreement that proficiency in performing independent US is an important factor in a fellow's future success as a pediatric radiologist. Given that baseline, it

Table 5 Fellows' and program directors' overall rating on a scale of 1–10 of educational experiences during fellowship regarding independent US instruction

	Not applicable	Poor (1–2)	Below average (3–4)	Average (5–6)	Above average (7–8)	Excellent (9–10)
Fellows (<i>n</i> =43)	4.7% (<i>n</i> =2)	7.0% (<i>n</i> =3)	4.7% (<i>n</i> =2)	32.6% (<i>n</i> =14)	32.6% (<i>n</i> =14)	18.6% (<i>n</i> =8)
Program directors (<i>n</i> =29)		0% (<i>n</i> =0)	3.4% (<i>n</i> =1)	41.4% (<i>n</i> =12)	41.4% (<i>n</i> =12)	13.8% (<i>n</i> =4)

would be reasonable to expect ample educational opportunities in US techniques with exposure to independent scanning.

Fellows were asked about their technical US exposure in residency as well as fellowship. Because residency serves as a foundation, the strength or weakness of this training period may influence their perception of hands-on US at the fellowship level. For example, eight fellows who were less likely to pursue independent US instruction during elective time commented that they had adequate experience in residency or fellowship. Five fellows specifically noted a sufficient residency experience.

Fellows were questioned regarding their exposure to independent scanning during workday rotations in US, unsupervised on-call scanning responsibilities, and the volume of cases being performed. Although a majority of fellows, 37/42 (88%), indicated that they were offered the opportunity to scan independently during fellowship and 34/42 (81%) reported independent scanning during US rotations, a significantly smaller percentage was responsible for unassisted scanning while on call (23.3%). Furthermore, the results demonstrated that pediatric radiology fellows actually had a drop in on-call scanning exposure during fellowship compared with residency, 23.3% and 43.9% respectively. The diminished role in US scanning by the fellows on call was further highlighted by the fact that 58.6% of program directors responded that their institution provides 24-h in-house or remote attending support for the final interpretation of all unsupervised cases performed by fellows.

Given that few fellows are independently scanning on-call, the opportunities provided by workday rotations assume greater importance. The obstacles that prevent a trainee from taking advantage of US scanning during the workday were illuminating. Although program directors and fellows alike cited volume of cases requiring immediate dictation as a common obstacle, the perception of other obstacles was discrepant. Most notably, fellows were more likely than directors to identify a lack of sufficient staffing to leave the workstation (55.8% vs. 24.1%), while directors were more likely to focus on fellows' lack of interest (41.4% vs. 14.0%) (Fig. 1). But directors may be misjudging fellows, because trainees clearly identified US as a crucial modality in their career development and half of responding fellows expressed interest in elective time or non-work/non-call hours in independent scanning. Understaffing, and its relationship to US, may require reassessment because this is a multifactorial issue involving expectations and perceptions of staff *and* trainees as well as daily fluctuation in number and complexity of cases.

Fellows and program directors were asked to indicate whether their programs had a designated curriculum for independent US scanning and to specify the features of that educational experience. A minority of fellows (41.9%)

responded that their program offered such instruction. Most fellows' educational experiences were likely gained from a non-structured format such as at the bedside during the clinical workday, because only 41.9% had some structured training. If the fellows' hands-on US instruction is occurring during the clinical workday at the bedside, then individual fellows may have different experiences even within the same program.

By contrast, curriculum design for hands-on US training has become a popular topic in undergraduate and graduate medical education as the expanding role of US has been recognized by medical educators and many clinical subspecialists. In fact, medical schools have developed and implemented US curriculums that begin as early as the first year of training [6, 7]. One such program is a 4-year progressive instruction in US including didactic lectures and demonstrations, hands-on laboratory tutorials in scanning techniques, Web-based learning modules, objective structured clinical examinations, and integration into clinical clerkships. This program may culminate in a fourth-year elective time working with emergency room physicians to scan patients in the acute setting [6].

Notably, non-radiologists have implemented hands-on US training. Emergency room physicians, for example, increasingly provide training to their residents and fellows in the independent performance of point-of-care US both as a component of graduate medical education and to expand the scope of the types of studies being performed [8]. In addition to obstetrics, gynecology and cardiology, other disciplines such as emergency medicine and critical care medicine have increasingly sought to incorporate US training and performance into their practice [9, 10]. Yet our survey results among pediatric radiology fellows demonstrate a shrinking technical US experience and limited educational opportunities for future pediatric radiologists. Radiologists must master the evaluation of multiple organ systems and evaluate complex patient cases often referred to the department by subspecialists. To best help this wide range of patients, radiologists should be equipped with all necessary technical expertise.

The noninvasive nature of US and the avoidance of radiation exposure have led to greater referral and utilization of US, resulting in an increased volume of sonographic studies. These demands require adequate staffing of sonographers and radiologists to maintain efficient schedules, which, in turn, promotes patient and referring physician satisfaction. But it is important not to compromise US education in the process.

Restructuring US training for pediatric radiology fellows may involve integrating didactic lectures, hands-on instruction, observation with feedback, video and printed reference materials and ensuring a minimum number of practice examinations of the most common types of studies. Perhaps in the beginning of the fellowship year a technical proficiency exam could be administered to assess the fellows' starting point.

Subsequently the tools above could be tailored to address specific deficiencies. Additionally, because fellows are open to instruction from sonographers, formalizing the technologists' roles in fellowship education may enhance the skill set of each participant. We are looking to evaluate new instructional methods in upcoming research.

The design of our questionnaires did not allow for matching fellowship director responses with the individual fellows who participate in their programs. While this may have encouraged the participation of some respondents, we recognize the limitations in comparing the responses between the surveys. The fellow survey did not inquire about the program name or size and therefore it is possible that some fellow responses may be skewed if multiple fellows from larger programs replied.

Conclusion

In an editorial in the *Journal of Clinical Ultrasound* in 1976, J. H. Holmes [11] wrote:

“This editorial will address itself primarily to the training of physicians. It seems to be a more difficult immediate problem than that of training ultrasonographers. Perhaps this is true because the training goals are not as well defined.”

Pediatric radiology fellows and fellowship program directors alike recognize the importance of technical US skills in the practice of pediatric radiology, yet both groups identify obstacles to training. With US instruction developing in undergraduate medicine and subspecialists eagerly acquiring point-of-care US skills, it is time to address the obstacles to technical education and formalize a US curriculum at the pediatric radiology fellowship level.

Conflicts of interest None

References

- (2011) ACR–SPR–SRU practice guideline for performing and interpreting diagnostic ultrasound examinations <http://www.acr.org/~media/13B896B9F4844E3082E7D7ED66AFC148.pdf>. Accessed 8 Sept 2013
- Hertzberg BS, Kliewer MA, Bowie JD et al (2000) Physician training requirements in sonography: how many cases are needed for competence? *AJR Am J Roentgenol* 174:1221–1227
- Babcock DS (2002) Meeting ACGME requirements for a pediatric radiology training program. *Pediatr Radiol* 32:545–548
- ACGME program requirement for graduate medical education in pediatric radiology, effective July 1, 2010. ACGME approved focused revision: September 30, 2012; Effective July 1, 2013. Available at http://www.acgme.org/acgmeweb/Portals/0/PFAssets/2013-PR-FAQ-PIF/424_pediatric_diag_rad_07012013_1-YR.pdf. Accessed 8 Sept 2013
- Strife JL, Amis ES (2010) Changes in ACGME program requirements for pediatric radiology fellowship programs. *Pediatr Radiol* 40: 1312–1314
- Hoppmann RA et al (2011) An integrated ultrasound curriculum (iUSC) for medical students: 4-year experience. *Crit Ultrasound J* 3:1–12
- Rao S, van Holsbeeck L, Musial JL et al (2008) A pilot study of comprehensive ultrasound education at the Wayne State University School of Medicine: a pioneer year review. *J Ultrasound Med* 27: 745–749
- Cook T, Hunt P, Hoppmann R (2007) Emergency medicine leads the way for training medical students in clinician-based ultrasound: a radical paradigm shift in patient imaging. *Acad Emerg Med* 14:558–561
- Garrood T, Platt P (2010) Rheumatology letters to the editor: access to training in MSK US. *Rheumatology* 49:391
- Taggart AJ, Wright SA, Ball E et al (2009) The Belfast musculoskeletal ultrasound course. *Rheumatology* 48:1073–1076
- Holmes JH (1976) Education training programs in ultrasound. *J Clin Ultrasound* 4:317–319